

CLAIMS

We Claim:

1. A method, comprising:
depositing a first sacrificial layer on a substrate;
forming an array of mirror plates on the first sacrificial layer, wherein a center-to-center distance between adjacent mirror plates is from 4.38 to 10.16 micrometers;
depositing a second sacrificial layer on the mirror plates with a thickness from 0.5 to 1.5 micrometers; and
forming a hinge support on the second sacrificial layer for each mirror plate for supporting the mirror plate; and
removing at least a portion of one or both sacrificial layers using a spontaneous vapor phase chemical etchant.
2. The method of claim 1, wherein the array of mirror plates has a diagonal from 0.55 inch to 0.8 inch.
3. The method of claim 1, wherein the array of mirror plates has a diagonal from 0.65 inch to 0.75 inch.
4. The method of claim 1, wherein the array of mirror plates has a diagonal around 0.7 inch.
5. The method of claim 1, wherein the array of mirror plates comprises at least 1280 mirror plates along a length of the array.
6. The method of claim 1, wherein the array of mirror plates comprises at least 1400 mirror plates along a length of the array.
7. The method of claim 1, wherein the array of mirror plates comprises at least 1600 mirror plates along a length of the array.

8. The method of claim 1, wherein the array of mirror plates comprises at least 1920 mirror plates along a length of the array.
9. The method of claim 1, wherein the step of forming the array of mirror plates on the first sacrificial layer further comprises:
forming the array of mirror plates such that adjacent mirror plates have a gap through which the first sacrificial layers is removed during the step of removing the first and second sacrificial layers, wherein the gap is from 0.15 to 0.5 micrometers.
10. The method of claim 9, wherein the gap is from 0.15 to 0.25 micrometers.
11. The method of claim 9, wherein the gap is from 0.25 to 0.5 micrometers.
12. The method of claim 9, wherein the gap is from 0.5 micrometers or less.
13. The method of claim 1, wherein the center-to-center distance between adjacent mirror plates is from 8.07 to 10.16 micrometers.
14. The method of claim 1, wherein the center-to-center distance between adjacent mirror plates is from 6.23 to 9.34 micrometers.
15. The method of claim 1, wherein the center-to-center distance between adjacent mirror plates is from 4.38 to 6.57 micrometers.
16. The method of claim 1, wherein the center-to-center distance between adjacent mirror plates is from 4.38 to 9.34 micrometers.
17. The method of claim 1, wherein the step of forming the hinge support on the second sacrificial layer for each mirror plate further comprises:
forming a hinge for the mirror plate such that, after removing the first and second sacrificial layer, a) the mirror plate can rotate relative to the substrate along a rotation axis that is parallel to but offset from a diagonal of the mirror plate when viewed from the top of

the mirror plate; and b) the mirror plate can rotate to an angle at least 14 degrees relative to the substrate; and

wherein the step of forming the array of mirror plates on the first sacrificial layer further comprises:

forming the array of mirror plates on the first sacrificial layer such that adjacent mirror plates have a gap from 0.15 to 0.5 micrometers therebetween.

18. The method of claim 1, wherein the step of forming the hinge support on the second sacrificial layer for each mirror plate further comprises:

forming a hinge for the mirror plate such that, after removing the first and second sacrificial layer, the mirror plate can rotate above the substrate to a rotation angle at least 14 degrees relative to the substrate.

19. The method of claim 1, further comprising:

forming an electrode for each mirror plate; and

disposing the electrode proximate to the mirror plate for electrostatically deflecting the mirror plate.

20. The method of claim 1, wherein the substrate is glass or quartz that is visible light transmissive.

21. The method of claim 1, further comprising:

depositing an anti-reflection film on a surface of the substrate.

22. The method of claim 1, further comprising:

depositing a light absorbing frame around an edge of the substrate.

23. The method of claim 1, wherein the step of removing the first and second sacrificial layer further comprises:

monitoring an endpoint of the sacrificial layer being removed using a residual gas analyzer.

24. The method of claim 1, wherein the first sacrificial layer and / or the second sacrificial layer are / is amorphous silicon.
25. The method of claim 1, wherein the spontaneous vapor phase etchant is an interhalogen.
26. The method of claim 1, wherein the spontaneous vapor phase etchant is a noble gas halide.
27. The method of claim 26, wherein the noble gas halide comprises xenon difluoride.
28. The method of claim 25, wherein the interhalogen comprises bromine trichloride or bromine trifluoride.
29. The method of claim 1, wherein the vapor phase chemical etchant is HF.
30. The method of claim 1, wherein a diluent is mixed with the vapor phase etchant during removing the first and second sacrificial layer.
31. The method of claim 30, wherein the diluent is selected from N₂, He, Ar, Kr and Xe.
32. The method of claim 1, wherein each mirror plate has an area; and wherein a ratio of a summation of the areas of all mirror plates of the mirror plate array to an area of the substrate is 90 percent or more.
33. The method of claim 1, wherein each mirror plate rotates relative to the substrate in response to an electrostatic force.
34. The method of claim 1, further comprising:
disposing a first electrode proximate to each mirror plate for electrostatically driving the mirror plate to rotate in a first direction relative to the substrate; and

disposing a second electrode proximate to the mirror plate for electrostatically driving the mirror plate to rotate in a second direction opposite to the first direction relative to the substrate.

35. The method of claim 34, wherein the first electrode and the second electrode are disposed on the same side relative to a rotation axis of the mirror plate.

36. The method of claim 34, wherein the first electrode and the second electrode are disposed on the opposite sides relative to a rotation axis of the mirror plate.

37. The method of claim 1, wherein the substrate is semiconductor.

38. The method of claim 1, wherein the step of forming the hinge support on the second sacrificial layer for each mirror plate further comprises:

forming a hinge for the mirror plate such that, after removing the first and second sacrificial layer, the mirror plate can rotate in a first direction to an angle from 15° degrees to 27° degrees relative to the substrate.

39. The method of claim 38, wherein the step of forming the hinge support on the second sacrificial layer for each mirror plate further comprises:

forming a hinge for the mirror plate such that, after removing the first and second sacrificial layer, the mirror plate can rotate in a second direction opposite to the first direction to an angle from 2° degrees to 9° degrees relative to the substrate.

40. The method of claim 1, wherein the step of forming the hinge support on the second sacrificial layer for each mirror plate further comprises:

forming a hinge for the mirror plate such that, after removing the first and second sacrificial layer, the mirror plate can rotate in a first direction to an angle from 17.5° degrees to 22.5° degrees relative to the substrate.

41. The method of claim 40, wherein the step of forming the hinge support on the second sacrificial layer for each mirror plate further comprises:

forming a hinge for the mirror plate such that, after removing the first and second sacrificial layer, the mirror plate can rotate in a second direction opposite to the first direction to an angle from 2° degrees to 9° degrees relative to the substrate.

42. The method of claim 1, wherein the step of forming the hinge support on the second sacrificial layer for each mirror plate further comprises:

forming a hinge for the mirror plate such that, after removing the first and second sacrificial layer, the mirror plate can rotate in a first direction to an angle around 20° degrees relative to the substrate.

43. The method of claim 42, wherein the step of forming the hinge support on the second sacrificial layer for each mirror plate further comprises:

forming a hinge for the mirror plate such that, after removing the first and second sacrificial layer, the mirror plate can rotate in a second direction opposite to the first direction to an angle from 2° degrees to 9° degrees relative to the substrate.

44. The method of claim 9, further comprises:

forming a hinge for the mirror plate such that, after removing the first and second sacrificial layer, the mirror plate can rotate in a first direction to an angle from 14° to 20° degrees relative to the substrate.

45. The method of claim 44, wherein the step of forming the hinge further comprises:

forming the hinge for the mirror plate such that, after removing the first and second sacrificial layer, the mirror plate can rotate in a second direction opposite to the first direction to an angle from 2° degrees to 9° degrees relative to the substrate.

46. The method of claim 9, further comprises:

forming a hinge for the mirror plate such that, after removing the first and second sacrificial layer, the mirror plate can rotate in a first direction to an angle around 12° degrees relative to the substrate.

47. The method of claim 46, wherein the step of forming the hinge further comprises:

forming the hinge for the mirror plate such that, after removing the first and second sacrificial layer, the mirror plate can rotate in a second direction opposite to the first direction to an angle from 2° degrees to 9° degrees relative to the substrate.

48. A spatial light modulator, comprising:
an array of mirror devices formed on a substrate for selectively reflecting light incident on the mirror devices, wherein each mirror device comprises:
a mirror plate for reflecting light;
a hinge attached to the mirror plate such that the mirror plate can rotate relative to the substrate, wherein the hinge and the mirror plate are spaced apart from 0.5 to 1.5 micrometers; and
a hinge support on the substrate for holding the hinge on the substrate; and
wherein adjacent mirror plates has a center-to-center distance from 4.3 to 10.16 micrometers.

49. The spatial light modulator of claim 48, wherein the array of mirror devices comprises at least 1280 mirror devices along a length of the array.

50. The spatial light modulator of claim 48, wherein the array of mirror devices comprises at least 1400 mirror devices along a length of the array.

51. The spatial light modulator of claim 48, wherein the array of mirror devices comprises at least 1600 mirror devices along a length of the array.

52. The spatial light modulator of claim 48, wherein the array of mirror devices comprises at least 1920 mirror devices along a length of the array.

53. The spatial light modulator of claim 48, wherein the array of mirror device has a diagonal from 0.55 to 0.8 inch.

54. The spatial light modulator of claim 48, wherein the array of mirror device has a diagonal from 0.65 to 0.75 inch.

55. The spatial light modulator of claim 48, wherein the array of mirror device has a diagonal around 0.7 inches.
56. The spatial light modulator of claim 48, wherein adjacent mirror plates have a gap from 0.15 to 0.5 micrometers therebetween when the mirror plates are parallel to the substrate.
57. The spatial light modulator of claim 56, wherein adjacent mirror plates have a gap from 0.25 to 0.35 micrometers therebetween when the mirror plates are parallel to the substrate.
58. The spatial light modulator of claim 48, wherein adjacent mirror plates have a gap of 0.5 micrometers or less therebetween when the mirror plates are parallel to the substrate.
59. The spatial light modulator of claim 48, wherein the center-to-center distance of adjacent mirror plates is from 8.07 to 10.16 micrometers.
60. The spatial light modulator of claim 48, wherein the center-to-center distance of adjacent mirror plates is from 6.23 to 9.34 micrometers.
61. The spatial light modulator of claim 48, wherein the center-to-center distance of adjacent mirror plates is from 4.38 to 6.57 micrometers.
62. The spatial light modulator of claim 48, wherein the center-to-center distance of adjacent mirror plates is from 3.6 to 5.3 micrometers.
63. The spatial light modulator of claim 48, wherein the mirror plate is attached to the hinge such that the mirror plate can rotate relative to the substrate along a rotation axis that is parallel to but offset from a diagonal of the mirror plate when viewed from the top of the mirror plate; and wherein the mirror plate can rotate to an angle at least 14 degrees relative to

the substrate; and wherein the adjacent mirror plates have a gap from 0.1 to 0.5 micrometers therebetween when the mirror plates are parallel to the substrate.

64. The spatial light modulator of claim 48, further comprising:
an electrode proximate to each mirror plate for electrostatically deflecting the mirror plate.

65. The spatial light modulator of claim 48, wherein the substrate is glass or quartz that is visible light transmissive.

66. The spatial light modulator of claim 65, wherein the substrate has an anti-reflection film on a surface of the substrate.

67. The spatial light modulator of claim 65, wherein the substrate comprises a light absorbing frame around an edge of the substrate.

68. The spatial light modulator of claim 48, wherein a ratio of a summation of all areas of all mirror plates to an area of the substrate is 90 percent or more.

69. The spatial light modulator of claim 48, wherein the mirror plate of each mirror device rotates relative the substrate in response to an electrostatic field.

70. The spatial light modulator of claim 48, wherein each mirror device further comprises:

a first electrode and circuitry that drives the mirror plate of said mirror device in a first rotational direction; and

a second electrode that drives said mirror plate in a second rotational direction opposite to the first rotational direction.

71. The spatial light modulator of claim 70, wherein the first electrode and the second electrode are on the same side relative to the rotation axis of the mirror plate.

72. The spatial light modulator of claim 70, wherein the first electrode and second electrode are on opposite sides relative to the rotation axis of the mirror plate.
73. The spatial light modulator of claim 48, wherein the substrate is semiconductor.
74. The spatial light modulator of claim 48, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a first direction to an angle from 15° degrees to 27° degrees relative to the substrate.
75. The spatial light modulator of claim 74, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a second direction to an angle from 2° degrees to 9° degrees relative to the substrate.
76. The spatial light modulator of claim 48, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a first direction to an angle from 17.5° degrees to 22.5° degrees relative to the substrate.
77. The spatial light modulator of claim 76, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a second direction to an angle from 2° degrees to 9° degrees relative to the substrate.
78. The spatial light modulator of claim 48, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a first direction to an angle around 20° degrees relative to the substrate.
79. The spatial light modulator of claim 78, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a second direction to an angle from 2° degrees to 9° degrees relative to the substrate.
80. The spatial light modulator of claim 48, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a first direction to an angle around 30° degrees relative to the substrate.

81. The spatial light modulator of claim 80, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a second direction to an angle from 2° degrees to 9° degrees relative to the substrate.

82. The spatial light modulator of claim 56, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a first direction to an angle from 14° degrees to 20° degrees.

83. The spatial light modulator of claim 82, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a second direction to an angle from 2° degrees to 9° degrees.

84. A spatial light modulator, comprising: an array of movable mirror plates formed on a substrate for selectively reflecting a light beam incident on the mirror plates, wherein adjacent mirror plates have a center-to-center distance from 4.38 to 10.16 micrometers.

85. The spatial light modulator of claim 84, wherein the array of mirror plates has a diagonal from 0.55 to 0.8 inch.

86. The spatial light modulator of claim 84, wherein the array of mirror plates has a diagonal from 0.65 to 0.75 inch.

87. The spatial light modulator of claim 84, wherein the array of mirror plates has a diagonal around 0.7 inch.

88. The spatial light modulator of claim 84, further comprising:
a hinge that is attached to each mirror plate such that the mirror plate can rotate relative to the substrate, wherein the hinge and the mirror plate are spaced apart from 0.1 to 0.45 micrometers.

89. The spatial light modulator of claim 98, wherein the hinge and the mirror plate is spaced apart from 0.2 to 0.3 micrometers.
90. The spatial light modulator of claim 84, wherein the hinge and the mirror plate is spaced apart from 0.5 to 1.5 micrometers.
91. The spatial light modulator of claim 90, wherein the hinge and the mirror plate is spaced apart from 0.75 to 1.25 micrometers.
92. The spatial light modulator of claim 90, wherein the hinge and the mirror plate is spaced apart from 0.9 to 1.15 micrometers.
93. The spatial light modulator of claim 84, wherein the array of mirror plates comprises at least 1280 mirror plates along a length of the mirror plate array.
94. The spatial light modulator of claim 84, wherein the array of mirror plates comprises at least 1400 mirror plates along a length of the mirror plate array.
95. The spatial light modulator of claim 84, wherein the array of mirror plates comprises at least 1600 mirror plates along a length of the mirror plate array.
96. The spatial light modulator of claim 84, wherein the array of mirror plates comprises at least 1920 mirror plates along a length of the mirror plate array.
97. The spatial light modulator of claim 84, wherein the adjacent mirror plates has a gap from 0.1 to 0.5 micrometers therebetween when the adjacent mirror plates are parallel to the substrate.
98. The spatial light modulator of claim 84, wherein the adjacent mirror plates has a gap from 0.2 to 0.25 micrometers therebetween when the adjacent mirror plates are parallel to the substrate.

99. The spatial light modulator of claim 84, wherein the adjacent mirror plates has a gap from 0.25 to 0.5 micrometers therebetween when the adjacent mirror plates are parallel to the substrate.

100. The spatial light modulator of claim 84, wherein the adjacent mirror plates has a gap of 0.5 micrometers or less therebetween when the adjacent mirror plates are parallel to the substrate.

101. The spatial light modulator of claim 84, wherein the center-to-center distance of adjacent mirror plates is from 8.07 to 10.16 micrometers.

102. The spatial light modulator of claim 84, wherein the center-to-center distance of adjacent mirror plates is from 6.23 to 9.34 micrometers.

103. The spatial light modulator of claim 84, wherein the center-to-center distance of adjacent mirror plates is from 4.38 to 6.57 micrometers.

104. The spatial light modulator of claim 84, wherein the center-to-center distance of adjacent mirror plates is from 4.38 to 9.34 micrometers.

105. The spatial light modulator of claim 84, further comprising: a hinge attached to the mirror plate such that the mirror plate can rotate relative to the substrate along a rotation axis that is parallel to but offset from a diagonal of the mirror plate when viewed from the top of the mirror plate; and wherein the mirror plate can rotate to an angle at least 14 degrees relative to the substrate; and wherein the adjacent mirror plates has a gap from 0.15 to 0.5 micrometers when the adjacent mirror plates are parallel to the substrate.

106. The spatial light modulator of claim 84, further comprising:
an electrode proximate to each mirror plate for electrostatically deflecting the mirror plate.

107. The spatial light modulator of claim 84, wherein the substrate is glass or quartz that is visible light transmissive.

108. The spatial light modulator of claim 107, wherein the substrate comprises an anti-reflection film on a surface of the substrate.

109. The spatial light modulator of claim 107, wherein the substrate comprises a light absorption frame around an edge of the substrate.

110. The spatial light modulator of claim 84, wherein each mirror plate has an area; and wherein a ratio of a summation of all areas of the mirror plates to an area of the substrate is 90 percent or more.

111. The spatial light modulator of claim 84, wherein an illumination efficiency of the mirror plate array is 90 percent or more.

112. The spatial light modulator of claim 84, wherein each mirror plate rotate relative to the substrate in response to an electrostatic field.

113. The spatial light modulator of claim 84, further comprising:
a first electrode that drives the mirror plate rotate in a first rotation direction relative to the substrate; and
a second electrode that drives the mirror plate rotate in a second rotation direction opposite to the first rotation direction relative to the substrate.

114. The spatial light modulator of claim 113, wherein the first electrode and the second electrode are on the same side relative to the rotation axis of the mirror plate.

115. The spatial light modulator of claim 113, wherein the first electrode and the second electrode are on the opposite sides relative to the rotation axis of the mirror plate.

116. The spatial light modulator of claim 84, wherein the substrate is semiconductor.

117. The spatial light modulator of claim 84, wherein the mirror plate is attached to a hinge such that the mirror plate rotates in a first direction to an angle from 15° degrees to 27° degrees relative to the substrate.

118. The spatial light modulator of claim 117, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a second direction to an angle from 2° degrees to 9° degrees relative to the substrate.

119. The spatial light modulator of claim 84, wherein the mirror plate is attached to a hinge such that the mirror plate rotates in a first direction to an angle from 17.5° degrees to 22.5° degrees relative to the substrate.

120. The spatial light modulator of claim 119, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a second direction to an angle from 2° degrees to 9° degrees relative to the substrate.

121. The spatial light modulator of claim 84, wherein the mirror plate is attached to a hinge such that the mirror plate rotates in a first direction to an angle around 20° degrees relative to the substrate.

122. The spatial light modulator of claim 120, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a second direction to an angle from 2° degrees to 9° degrees relative to the substrate.

123. The spatial light modulator of claim 84, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a first direction to an angle around 30° degrees relative to the substrate.

124. The spatial light modulator of claim 123, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a second direction to an angle from 2° degrees to 9° degrees relative to the substrate.

125. The spatial light modulator of claim 87, wherein a gap between adjacent mirror plates is from 0.1 to 0.5 micrometers.

126. The spatial light modulator of claim 90, wherein a gap between adjacent mirror plates is from 0.2 to 0.3 micrometers.

127. The spatial light modulator of claim 90, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a first rotation direction to an angle from 14° degrees to 20° degrees.

128. The spatial light modulator of claim 127, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a second rotation direction to an angle from 2° degrees to 9° degrees, the second rotation direction being opposite to the first rotation direction.

129. The spatial light modulator of claim 125, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a first rotation direction to an angle from 14° degrees to 20° degrees.

130. The spatial light modulator of claim 129, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a second rotation direction to an angle from 2° degrees to 9° degrees, the second rotation direction being opposite to the first rotation direction.

131. The spatial light modulator of claim 97, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a first rotation direction to an angle from 14° degrees to 20° degrees.

132. The spatial light modulator of claim 131, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a second rotation direction to an angle from 2°

degrees to 9° degrees, the second rotation direction being opposite to the first rotation direction.

133. A projection system, comprising:
- a light source;
 - a spatial light modulator that further comprises:
 - an array of mirror devices formed on a substrate for selectively reflecting light incident on the mirror devices, wherein each mirror device comprises:
 - mirror plate for reflecting light;
 - hinge attached to the mirror plate such that the mirror plate can rotate relative to the substrate, wherein the hinge and the mirror plate are spaced apart from 0.5 to 1.5 micrometers; and
 - a hinge support on the substrate for holding the hinge on the substrate; and
 - wherein adjacent mirror plates has a center-to-center distance from 4.3 to 10.16 micrometers;
 - a condensing optic element for directing light from the light source onto the spatial light modulator; and
 - a projecting optic element for collecting and directing light reflected from the spatial light modulator onto a display target.
134. The projection system of claim 133, wherein the light source is an arc lamp having an arc length of 1.0 mm or less.
135. The projection system of claim 133, wherein the light source is an arc lamp having an arc length of 0.8 mm or less.
136. The projection system of claim 133, wherein the light source is an arc lamp having an arc length around 0.7 mm.
137. The projection system of claim 133, wherein the array of mirror plates has a diagonal from 0.55 to 0.8 inch.

138. The projection system, wherein the array of mirror plates has a diagonal from 0.65 to 0.75 inch.

139. The projection system, wherein the array of mirror plates has a diagonal around 0.7 inch.

140. The system of claim 133, wherein the array of mirror devices comprises at least 1280 mirror devices along a length of the array.

141. The system of claim 133, wherein the array of mirror devices comprises at least 1400 mirror devices along a length of the array.

142. The system of claim 133, wherein the array of mirror devices comprises at least 1600 mirror devices along a length of the array.

143. The system of claim 133, wherein the array of mirror devices comprises at least 1920 mirror devices along a length of the array.

144. The system of claim 133, wherein adjacent mirror plates have a gap from 0.15 to 0.25 micrometers therebetween when the mirror plates are parallel to the substrate.

145. The system of claim 133, wherein adjacent mirror plates have a gap from 0.25 to 0.5 micrometers therebetween when the mirror plates are parallel to the substrate.

146. The system of claim 133, wherein adjacent mirror plates have a gap of 0.5 micrometers or less therebetween when the mirror plates are parallel to the substrate.

147. The system of claim 133, wherein the center-to-center distance of adjacent mirror plates is from 8.07 to 10.16 micrometers.

148. The system of claim 133, wherein the center-to-center distance of adjacent mirror plates is from 6.23 to 9.34 micrometers.

149. The system of claim 133, wherein the center-to-center distance of adjacent mirror plates is from 4.38 to 6.57 micrometers.

150. The system of claim 133, wherein the center-to-center distance of adjacent mirror plates is from 4.38 to 9.34 micrometers.

151. The system of claim 133, wherein the mirror plate is attached to the hinge such that the mirror plate can rotate relative to the substrate along a rotation axis that is parallel to but offset from a diagonal of the mirror plate when viewed from the top of the mirror plate; and wherein the mirror plate can rotate to an angle at least 14 degrees relative to the substrate; and wherein the adjacent mirror plates have a gap from 0.15 to 0.5 micrometers therebetween when the mirror plates are parallel to the substrate.

152. The system of claim 133, further comprising:
an electrode proximate to each mirror plate for electrostatically deflecting the mirror plate.

153. The system of claim 133, wherein the substrate is glass or quartz that is visible light transmissive.

154. The system of claim 153, wherein the substrate has an anti-reflection film on a surface of the substrate.

155. The system of claim 153, wherein the substrate comprises a light absorbing frame around an edge of the substrate.

156. The system of claim 133, wherein a ratio of a summation of all areas of all mirror plates to an area of the substrate is 90 percent or more.

157. The system of claim 133, wherein the mirror plate of each mirror device rotates relative the substrate in response to an electrostatic field.
158. The system of claim 133, wherein each mirror device further comprises:
a first electrode and circuitry that drives the mirror plate of said mirror device in a first rotational direction; and
a second electrode that drives said mirror plate in a second rotational direction opposite to the first rotational direction.
159. The system of claim 158, wherein the first electrode and the second electrode are on the same side relative to the rotation axis of the mirror plate.
160. The system of claim 158, wherein the first electrode and second electrode are on opposite sides relative to the rotation axis of the mirror plate.
161. The system of claim 133, wherein the substrate is semiconductor.
162. The system of claim 133, wherein the light source is an arc lamp having an effective arc length around 1.0 millimeter.
163. The system of claim 133, wherein the light source is an arc lamp having an effective arc length less than 1.0 millimeter.
164. The system of claim 133, wherein the light source is an arc lamp having an effective arc length around 0.7 millimeter.
165. The system of claim 133, further comprising:
a video signal input that inputs a plurality of video signals, based on which the mirror plates of the spatial light modulator selectively reflect light such that the reflected light from the mirror plates forms a plurality of consecutive video frames on the display target.

166. The system of claim 133, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a first direction to an angle from 15° degrees to 27° degrees relative to the substrate.

167. The system of claim 166, wherein the mirror plate is attached to the hinge such that the mirror plate rotates to in a second direction opposite to the first direction to an angle from 2° degrees to 9° degrees relative to the substrate.

168. The system of claim 133, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a first direction to an angle from 17.5° degrees to 22.5° degrees relative to the substrate.

169. The system of claim 168, wherein the mirror plate is attached to the hinge such that the mirror plate rotates to in a second direction opposite to the first direction to an angle from 2° degrees to 9° degrees relative to the substrate.

170. The system of claim 133, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a first direction to an angle around 20° degrees relative to the substrate.

171. The system of claim 168, wherein the mirror plate is attached to the hinge such that the mirror plate rotates to in a second direction opposite to the first direction to an angle from 2° degrees to 9° degrees relative to the substrate.

172. The system of claim 133, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a first direction to an angle around 20° degrees relative to the substrate.

173. The system of claim 172, wherein the mirror plate is attached to the hinge such that the mirror plate rotates to in a second direction opposite to the first direction to an angle from 2° degrees to 9° degrees relative to the substrate.

174. The system of claim 133, wherein the mirror plate is attached to the hinge such that the mirror plate rotates in a first direction to an angle around 30° degrees relative to the substrate.

175. The system of claim 174, wherein the mirror plate is attached to the hinge such that the mirror plate rotates to in a second direction opposite to the first direction to an angle from 2° degrees to 9° degrees relative to the substrate.

176. A projector comprising:
a light source; and
a spatial light modulator that further comprises:
an array of movable mirror plates formed on a substrate for selectively reflecting a light beam incident on the mirror plates, wherein adjacent mirror plates have a center-to-center distance from 4.38 to 10.16 micrometers.

177. The projector of claim 176, wherein the array of movable mirror plates comprises at least 1280 mirror plates along a length of the array.

178. The projector of claim 176, wherein the array of movable mirror plates comprises at least 1400 mirror plates along a length of the array.

179. The projector of claim 176, wherein the array of movable mirror plates comprises at least 1600 mirror plates along a length of the array.

180. The projector of claim 176, wherein the array of movable mirror plates comprises at least 1920 mirror plates along a length of the array.

181. The projector of claim 176, wherein the light source is an arc lamp having an arc length of 1.0 mm or less.

182. The projector of claim 176, wherein the light source is an arc lamp having an arc length of 0.7 mm or less.

183. A projector, comprising:
- an arc lamp having an arc length of 1.0 mm or less;
 - a spatial light modulator having a diagonal from 0.55 to 0.8 inch, wherein the spatial light modulator further comprises an array of micromirror devices for selectively reflecting light from the arc lamp, the array of micromirror devices further comprising:
 - a center-to-center distance between adjacent micromirror devices from 4.38 to 10.16 micrometers;
 - a gap between the adjacent micromirror devices from 0.1 to 0.5 micrometers;
 - and
 - a plurality of micromirror devices, each micromirror device further comprising:
 - a mirror plate attached to a hinge and a hinge support on a substrate such that the mirror plate can rotate relative to the substrate, wherein the mirror plate and the hinge is spaced apart from 0.5 to 1.5 micrometers; and
 - a plurality of optical elements for condensing light from the arc lamp onto the spatial light modulator and projecting light reflected from the spatial light modulator onto a display target.
184. The projector of claim 183, wherein the spatial light modulator comprises at least 1280 micromirror devices along a length of the spatial light modulator.
185. The projector of claim 183, wherein the spatial light modulator comprises at least 1920 micromirror devices along a length of the spatial light modulator.
186. The projector of claim 183, wherein the light source is an arc lamp having an arc length of 0.7 mm or less.
187. The projector of claim 183, wherein the light source is an arc lamp having an arc length around 0.7 mm.